BIOCHEMISTRY

SECOND EDITION

THE MOLECULAR BASIS

OF CELL STRUCTURE AND FUNCTION

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EXHIBIT 1

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CHAPTER 5 PROTEINS: COVALENT BACKBONE AND AMINO ACID SEQUENCE

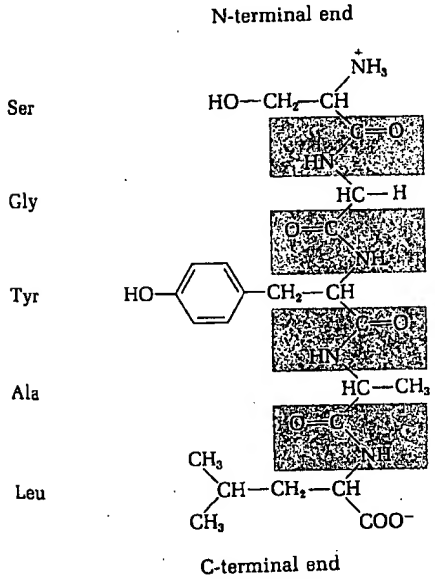
In this chapter we examine various aspects of the primary structure of proteins, which we have defined (page 60) as the covalent backbone structure of polypeptide chains, including the sequence of amino acid residues. We begin by considering the properties of simple peptides. Then we examine three major problems: (1) the determination of amino acid sequence in polypeptide chains, (2) the significance of variations in the amino acid sequences of different proteins in different species, and (3) the laboratory synthesis of polypeptide chains. We shall use various terms and concepts already defined in Chapter 3, which may be referred to for orientation.

The Structure of Peptides

Simple peptides containing two, three, four, or more amino acid residues, i.e., dipeptides, tripeptides, tetrapeptides, etc., joined covalently through peptide bonds, are formed on partial hydrolysis of much longer polypeptide chains of proteins. Many hundreds of different peptides have been isolated from such hydrolyzates or synthesized by chemical procedures (page 117). Peptides are also formed in the gastrointestinal tract during the digestion of proteins by proteases, enzymes that hydrolyze peptide bonds. Peptides are named from their component amino acid residues in the sequence beginning with the amino-terminal (abbreviated N-terminal) residue (Figure 5-1).

Much evidence supports the conclusion that the peptide bond is the sole covalent linkage between amino acids in the linear backbone structure of proteins. This evidence comes not only from chemical- and enzymatic-degradation studies, but also from various physical measurements. For example, proteins have absorption bands in the far ultraviolet (180 to 220 nm) and infrared regions that are similar to those given by authentic peptides. Furthermore, x-ray diffraction analysis (Chapter 6) directly shows the presence of peptide bonds in native proteins. There is only one other major covalent linkage between amino acids: the disulfide bond of cystine (page 86) serves in some proteins as a cross-link

Figure 5-1
Structure of a pentapeptide. Peptides are named beginning with the N-terminal residue. The peptide bonds are shaded in color.



Serylglycyltyrosylalanylleucine
(Ser-Gly-Tyr-Ala-Leu)